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THE USE OF NATURAL GAS IN THE SARATOVENERGO ELECTRIC POWER PLANTS

During five years of utilizing natural gas in the Saratovenergo Electric Power Plants, much experience has been gained in using gas to fire powerful boilers as well as in constructing and using gas pipe line systems.

The following defects were noticed in the use of these gas pipe lines: unsatisfactory construction of welded joints, freezing of drill heads, generation of gaseous hydrates, generation of vapor locks in the pipe lines due to improper installation, presence of water in the pipe lines, and unsatisfactory construction of drain pipes.

The Saratovenergo Electric Power Plants consider a single, sectionalized gas main with two inlets for the boiler discharge to be the most expedient method for providing an inter-power plant gas pipe line system.

The method of supplying gas to large consumers whose rate of load is extremely variable has a very important effect on the persistency of the boiler gas at the electric power plants, since the output of the boilers drops with a lowering of the gas pressure in the pipes. Therefore, the joint solution of the problems of regulating the rate of load of the electric power plants and the rate of gas supplied to consumers has a very practical importance.

Tests have shown that efficiency in the burning of gas depends, in the first instance, upon a complete mixing of the gas with air in the gas jet before it goes into the furnace.

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The construction of powerful gas jets must insure a complete mixing of gas and air in the jet, operation at low gas pressure, and a wide regulative range without danger of reverse ignition. Saratovenergo does not consider it expedient to combine burning gas and pulverized fuel in one jet.

The question of the expediency of an apparatus with a large number of small jets in the boiler, or an apparatus with large jets demands further study.

Up to the present, methods of calculating the quantity and quality of gas consumed have not received sufficiently satisfactory solutions.

On the basis of experience of utilizing natural gas at the Saratovenergo Electric Power Plants, the Technical Council adopted the following decisions:

1. In supplying gas for large electric power plants having a variable rate of gas consumption, it is necessary to determine at the inlet, the limits of fluctuation in gas pressure, which correspond to the minimum and maximum consumption of gas, and to ascertain the possibility of guaranteeing these limits in the projected system of gas supply.

The most advantageous minimum gas pressure with a maximum consumption by electric power plant is from 0.5 to 1.0 kg/sq cm, because then the use of extremely large-diameter ramifying networks inside the boiler is successfully avoided, and the maintenance of a full gas pressure behind the jets is facilitated.

2. In planning gas supply for electric power plants, it is considered necessary to join the electric power plants' feeder lines to an independent network.

3. In order that large electric power plants connected to the gas network may act as convenient regulators of total gas consumption, regulation of the rate of electrical load and equalization of the rate of gas consumption must be linked with the rate of gas consumption by other consumers.

4. Calculation of the quantity of natural gas consumed must be made more precise in regard to the influence exerted by separate parameters, which make up the computing formula (change in moisture content, temperature, specific gravity, etc.). Special instruction is required for this purpose.

5. Up to the present time, determining the calorific content of natural gas in electric power plants which use this fuel has not been effected. (There is no certain method, and in most cases the calorific content of gas is being determined by its elemental composition and not by special calorimeters). It is considered necessary to work out a method for determining the calorific content of natural gas with calorimeters and to issue instructions to workers.

6. It is considered necessary to devise a jet construction for large boilers that would provide preliminary, complete mixing of the gas and air before its expulsion from the jet into the furnace.

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7. In planning the change-over of boilers from heating with pulverized coal to firing with natural gas, it is necessary to observe the following special features:

a. Ability to change the temperature of superheated steam.

b. Necessity of eliminating all dead space in the conduits of the boiler where explosive mixtures of gas and air may collect.

c. Necessity of installing safety valves in the furnace, in the boiler's gas conduits and, in many cases, even in the air-feeder pipes.

d. Inexpediency of combining pulverized coal jets with gas types, since with separate jets it is easy to insure economy of burning and to meet engineering safety requirements.

e. Increased corrosion activity of the products of combustion, formed by burning of sulfurous natural gas or by the burning of gas and solid or liquid sulfurous fuels together.

8. In designing, assembling, and exploiting a system of gas pipe lines, it is necessary to pay particular attention to guaranteeing the mechanical durability of the welded seams, to the impenetrability of the collar and flange joints, and to accuracy in laying pipe. It is also desirable to devise a type of collarless fitting.

9. In laying the gas pipe lines in the ground, great care must be taken with regard to anticorrosive insulation. It is not permissible to use petroleum oil waste for this purpose.

10. It is considered necessary that the Technical Council be charged

a. Promulgating safety rules for the operation of equipment.

b. Determining optimum conditions (from the point of view of national economy) for the use of natural gas and other sources of high and low potential thermal energy.

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